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Frenkelia microti Infection in a Chinchilla (*Chinchilla laniger*) in the United States

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ABSTRACT: A *Frenkelia microti* tissue cyst was found in the brain of a chinchilla (*Chinchilla laniger*) used for biomedical research. This is the first report of *Frenkelia* infection in this animal in the United States.

Frenkelia microti (Findley and Middleton, 1934) Biocca, 1968 is a coccidian with many species of small mammals as intermediate hosts, and buzzards (*Buteo buteo*) and hawks (*B. borealis* and *B. jamaicensis*) as definitive hosts (Rommel and Krampitz, 1975; Dubey et al., 1989; Lindsay et al., 1992; Upton and Mckown, 1992). Intermediate hosts become infected by ingesting sporocysts or oocysts shed in the feces of definitive hosts. Merogony occurs mostly in hepatocytes, and tissue cysts are found in the brain (Rommel and Krampitz, 1975; Gobel et al., 1978). Tissue cysts of *Frenkelia* are lobulate and can be macroscopic. The life cycle of *Frenkelia* is similar to *Sarcocystis* and some authors regard *Frenkelia* as a synonym of *Sarcocystis* (Votýpka et al., 1998; Mugridge et al., 1999).

In North America, tissue cysts of *Frenkelia* have been reported from wild voles (*Microtus modesticus*; Frenkel, 1953, 1956), a rat (*Rattus rattus*; Hayden et al., 1976), a muskrat

(*Ondatra zibethica*), and a porcupine (*Erithizon dorsatum*; Karstad, 1963; Kennedy and Frelie, 1986). The only report of a *Frenkelia* infection in chinchillas (*Chinchilla laniger*) is from Germany (Meingassner and Burtscher, 1977). We herein report a *F. microti* infection in a chinchilla in the United States.

The animal was a retired breeder female obtained from a supplier in Rochester, Minnesota. It was from a group of chinchillas used for biomedical research on noise-induced hearing loss. The chinchillas were housed individually and fed commercial chinchilla chow, supplemented with raisins, carrots, and apples.

No clinical signs were noted. The animal was killed in good health and necropsied. Specimens from all major organs were fixed in 10% buffered neutral formalin. Paraffin-embedded sections were cut at 5 μm thickness and examined after staining with hematoxylin and eosin.

One large lobulated tissue cyst was seen in the cerebrum near the meninges (Fig. 1A). The tissue cyst was 330 μm long and 220 μm wide. The cyst wall was thin (<0.5 μm thick) and enclosed hundreds of bradyzoites (Fig. 1B). Septa were thin; there was no host reaction.

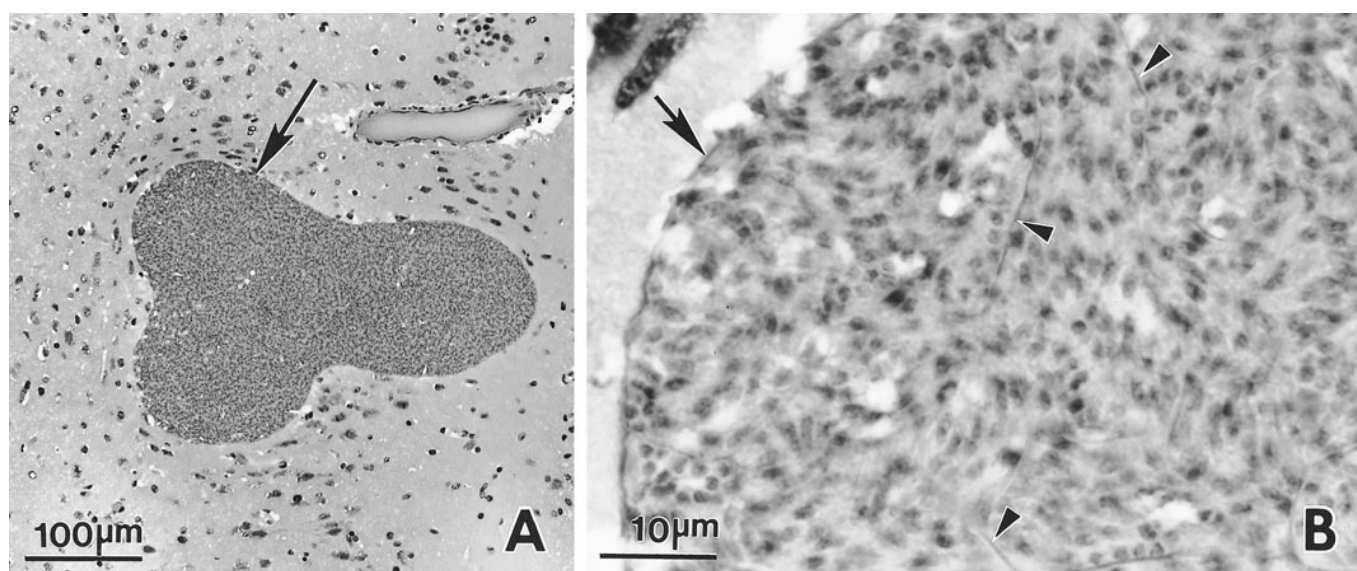


Figure 1. *Frenkelia microti* tissue cyst in the cerebrum of chinchilla. A. A low magnification showing a lobulated tissue cyst (arrow). B. Tissue cyst with cyst wall (arrow) and thin septa. Hematoxylin and eosin stain.

The tissue cyst in this chinchilla was probably an incidental finding. The chinchilla probably became infected by ingesting food contaminated with feces of an infected hawk. The tissue cyst phase of *Frenkelia* generally does not cause clinical signs in animals (Dubey et al., 1989). Although the merogonic phase of *Frenkelia* spp. in naturally infected animals is unknown, merogony occurs in hepatocytes in experimentally infected animals, and can be pathogenic (Rommel and Krampitz, 1975; Gobel et al., 1978). *Frenkelia* meronts are structurally similar to those of *Sarcocystis* spp that develop in parenchymal cells, e.g., *Sarcocystis muris* with cat-mouse cycle. Acute hepatic sarcocystosis was reported in 2 chinchillas by Rakich et al. (1992), and has been seen in 3 other chinchillas in the United States (J. Dubey, unpublished observation). Whether acute hepatic sarcocystosis in chinchillas represents a phase of *F. microti* needs investigation. In this respect, of the 22 chinchillas necropsied over the past year at the Naval Medical Center, San Diego, 14 had gross hepatic lesions with an undetermined etiology.

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Immunohistochemical Confirmation of *Sarcocystis neurona* Infections in Raccoons, Mink, Cat, Skunk, and Pony

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ABSTRACT: In the central nervous system of 2 raccoons, 1 cat, 1 pony, 2 mink, and 1 skunk, protozoa previously thought to be *Sarcocystis*-like reacted positively to *Sarcocystis neurona*-specific antibodies in an immunohistochemical test. In addition, *S. neurona* was identified in the brain of another skunk. These observations indicate that *S. neurona* is not confined to opossums and horses.

Sarcocystis neurona is an etiologic agent for equine protozoal myeloencephalitis (EPM) in horses, and EPM is the most common cause of neurologic disorders in horses in the Americas (Dubey et al., 1991; Hamir et al., 1992; MacKay, 1997). The life cycle of *S. neurona* is not fully known. The opossum (*Didelphis virginiana*) is a definite host, and horses are considered aberrant intermediate hosts. Horses are thought to become

infected by ingesting *S. neurona* sporocysts excreted in the feces of opossums (Fenger et al., 1997; Dubey and Lindsay, 1998). How opossums become infected with *S. neurona* is not known because intermediate hosts harboring *S. neurona* sporocysts are not known. Only schizonts and merozoites are found in tissues of horses, and these stages are confined to the brain and the spinal cord. Live *S. neurona* has been isolated only from the central nervous system (CNS) of horses and the intestines of opossums (Dubey et al., 1991; Dubey and Lindsay, 1998). Recently, *S. neurona*-like infections were found in sea lions from California and a sea otter from Oregon; the protozoa in the CNS of these animals reacted with *S. neurona* antibody (Lapointe et al., 1998; Rosonke et al., 1999). More recently, *S.*